Biological Evaluation of the Mountain Pine Beetle Outbreak in Yellowstone National Park 1969

The following is a report on the status of the mountain pine beetle outbreak in the southwestern corner of Yellowstone National Park. Material for this report was compiled from aerial survey data, from information collected during our annual mountain pine beetle impact study survey conducted in the Bechler area, and from information collected on the neighboring Targhee National Forest.

Historically, the outbreak in the Park is part of a general infestation that started on and adjacent to the Targhee National Forest in the early 1960's. The infestation reached concernful proportions in 1964, and chemical control was initiated on the Forest in 1965 to suppress the beetle population. Even though the pace of the infestation was slowed by this measure, the epidemic continued to spread and intensify. By 1966, the infestation had progressed to the Park boundary. The 1967 aerial survey map, which exhibits mortality caused by 1966 attacks, shows the progress of the infestation (Fig. 1). In 1967 the infestation spread three to four miles into the Park. The heaviest tree killing occurred along the south boundary and decreased to the north. A systematic survey conducted by Yellowstone Park personnel indicated that there were slightly more than 18,000 dead trees in a 6,000-acre area. Our 1968 aerial survey map showed the extent of the faders (Fig. 2). In the fall of 1968, a similar survey by Park personnel, though less intensive, showed that the infestation had increased in intensity and had moved further north. An estimated 265,000 newly infested trees were located over 58,600 acres. The 1969 aerial survey map revealed this spread (Fig. 3).

While an active infestation was progressing in the Park during the period from 1966-1969, insect losses on the Forest were curtailed through chemical control. Treatment was undertaken over a 165,000-acre area to the west of the Park and north of the Cave Falls Highway. Targhee National Forest treating records for the past two years show how losses were reduced. In this area, 299,882 infested trees were treated in 1968 and 214,047 in 1969. This was a reduction in mortality of approximately 29 percent.

The situation south of the Cave Falls Highway varied radically from that in the north. Chemical suppression was terminated in this area in the spring of 1967. Aerial survey records show that the mortality in 1968 increased to a high level. A similar increase was observed in 1969. Beetle flights from this area probably contributed to the situation in the Park during this period of time.

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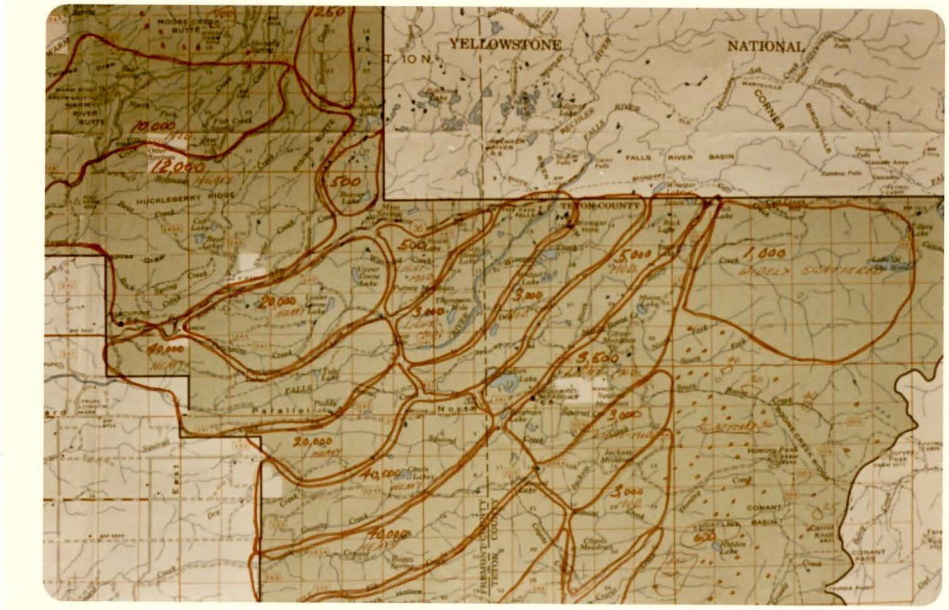

Figure 1. The distribution of mountain pine beetle killed lodgepole pine, as recorded during the 1967 aerial survey, is shown above. The red lines mark the extent of the attacks, and the number within each circled area is an estimate of the current faders.

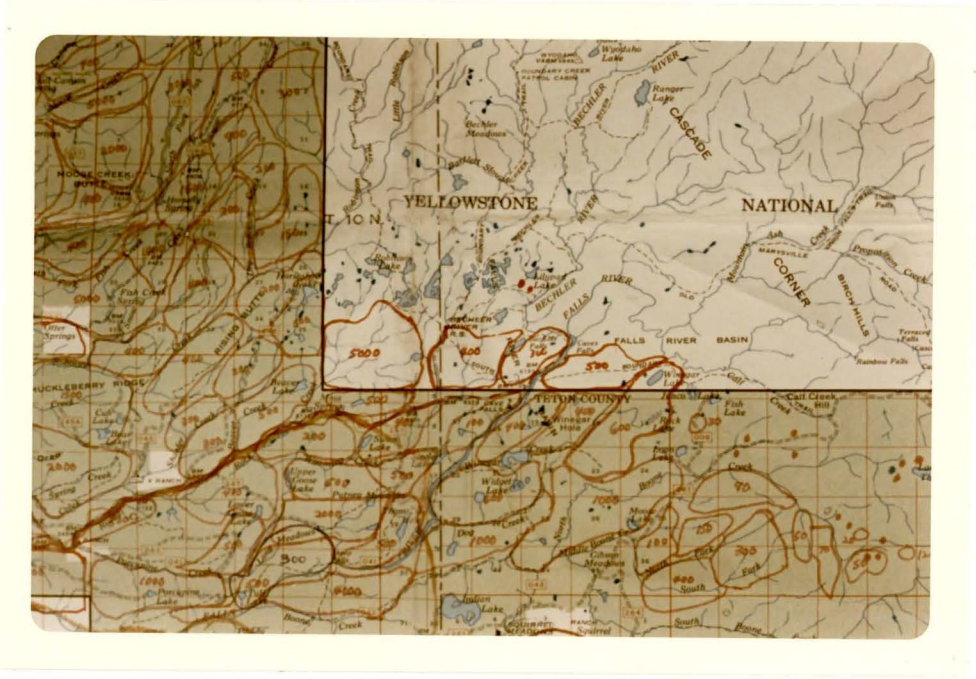

Figure 2. Aerial survey records for 1968, as shown above, reveal the distribution of the 1967 killed trees.

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Figure 3. The 1969 aerial survey map shows that the infestation increased in size and intensity over the 1968 level. The areas circled in purple denote Douglas-fir beetle activity.

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For the past two years, we have conducted surveys to measure the impact of the mountain pine beetle on a lodgepole pine stand. Besides obtaining impact data, we also gained information on the trend of the infestation. The survey procedure was unchanged from that previously reported. 1/

The cruise data reveal that 51.0 trees per acre have been lost since the beginning of the infestation. Initially, there were 211.6 green stems per acre. This figure dropped to 207.9 in 1966, 202.6 in 1967, 189.4 in 1968, and 160.9 in 1969 (Fig. 4). A total of 24 percent of the stand was killed during the period from 1965-1969. A breakdown of the green stand data follows:

NUMBER OF TREES/ACRE D.B.H. (2" Classes)								
YEAR	6	8	10	12	14	16	>16	TOTAL
1965	79.7	62.8	39.8	17.2	7.9	2.0	2.2	211.6
1966	79.4	61.9	39.0	16.6	7.4	1.7	1.9	207.9
1967	79.4	61.0	37.9	15.2	6.1	1.4	1.9	202.6
1968	79.4	58.3	34.0	12.2	3.9	0.8	0.8	189.4
1969	77.0	50.3	23.1	7.9	1.7	0.5	0.7	160.9

An analysis of tree mortality by 2-inch diameter classes shows that a greater percentage of large diameter trees have been lost. Trees in the larger diameter classes comprise only a small proportion of the stand; however, they hold a major portion of the volume. Approximately 48 percent of the trees 12 inches in diameter and above have been lost to date. A summary of the percent mortality by 2-inch diameter classes follows:

PERCENT MORTALITY D.B.H. (2" Classes)							
YEAR	6	8	10	12	14	16	>16
1966	0.4	1.4	2.0	3.5	6.3	15.0	13.6
1967	-	1.4	2.8	8.1	16.5	15.0	13.6
1968	-	4.3	9.8	17.4	27.8	30.0	36.4
1969	0.3	13.2	27.4	25.0	27.8	15.0	4.5
Total	0.7	20.3	42.0	54.0	78.4	75.0	68.1

1/ Biological evaluation of the mountain pine beetle outbreak in Yellowstone National Park 1968. Illus. 8 p. (Typed).

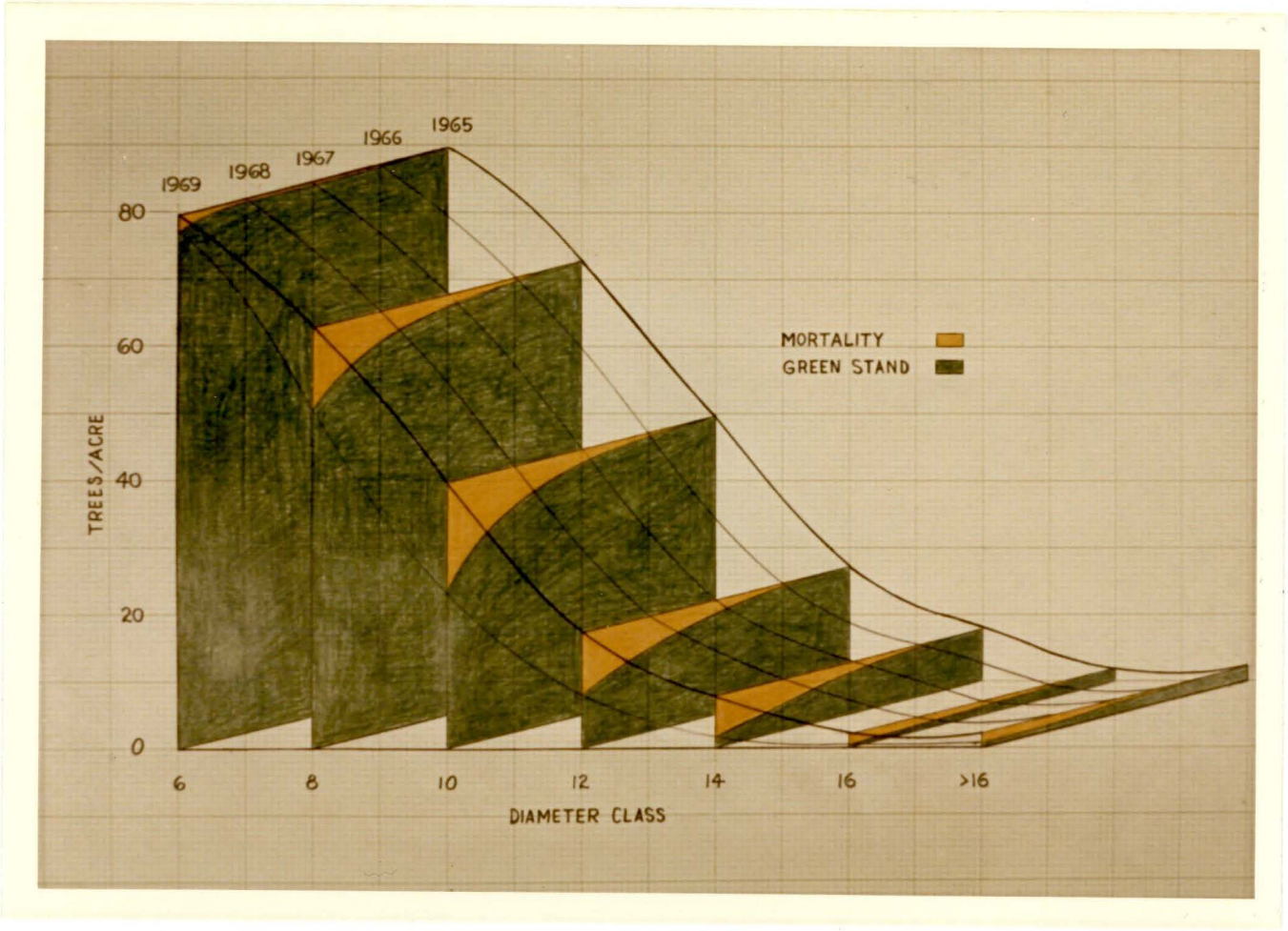

Figure 4. The above three-dimensional graph shows mountain pine beetle caused mortality and green stand data by trees per acre, diameter class, and year in the southwestern corner of Yellowstone National Park.

Since the stand is not being managed for timber, the number of trees killed is more important than the reduction in volume. At present, 51.0 trees per acre or 24 percent of the stand is dead. A resume' of mortality by 2-inch diameter classes for four consecutive years follows:

MORTALITY BY TREES/ACRE D.B.H. (2" Classes)								
YEAR	6	8	10	12	14	16	>16	TOTAL
1966	0.3	0.9	0.8	0.6	0.5	0.3	0.3	3.7
1967	-	0.9	1.1	1.4	1.3	0.3	0.3	5.3
1968	-	2.7	3.9	3.0	2.2	0.6	0.8	13.2*
1969	2.4	8.3	10.9	4.3	2.2	0.3	0.1	28.5
Total	3.0	12.8	16.7	9.3	6.2	1.5	1.5	51.0

*In the 1968 biological evaluation, it was reported that there were 19.7 current attacks per acre. Many of these attacks were found to be green this year. Therefore, the total mortality figure was corrected. A similar check of the 1969 attacks will be made next fall.

The information we have collected, as well as that collected by Park personnel, indicates that the number of lodgepole pine faders next summer will exceed the 1969 level. Along the south boundary, most of the larger trees have already been killed. The infestation will be sustained in smaller diameter trees in this area. The infestation to the north is more recent and a greater number of large diameter trees remain. Beetle activity in the large diameter trees will be more prevalent in this area.

Due to the depletion of the large diameter trees in the south, the beetle population should show signs of leveling off after the 1970 fall flight. There are two reasons why this will occur. First, larger diameter trees on the average have thicker phloem--which provides more food for the broods--and this characteristic produces more beetles. Secondly, depletion of the larger trees will force the beetles to attack smaller trees which produce significantly fewer beetles.

In the north, however, the situation is different. A sufficient number of large diameter trees still remain to permit the population to increase. It is difficult to predict the size of the increase, but it should not exceed twice the 1970 level of mortality.

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We do not recommend chemical suppression of the infestation in the Park. We have found from experience gained in other areas where control was undertaken that chemical control only slowed mountain pine beetle epidemics. Ultimate survival in control areas is equal to that in noncontrol areas.

Numerous references in the entomological literature and elsewhere state that all trees three inches in diameter and above can be lost during a mountain pine beetle epidemic. We have yet to find an area where losses were this dramatic. We have found that the overall losses of trees greater than four inches in diameter average around 30 percent of the stand. Our records show that there were epidemics on the Forest and Park from 1928 to 1939 and from 1948 to 1953. If all trees three inches in diameter and above had been killed during any one of these epidemics, none of the others could have begun. It should be apparent that even after these epidemics a major portion of the original stand was not affected.

The Targhee National Forest has recently sold 150 million board feet of timber in an area to the west of the Park. Chemical control is being planned in this area to limit losses until the timber can be removed. This measure is necessary not only to momentarily retard tree killing on the Forest, but to minimize the effects of beetle invasion from the Park.

Douglas L. Parker

Douglas L. Parker, Entomologist